DOCUMENT RESUME

ED 236 675 CS 207 951

AUTHOR Nugent, Susan Monroe; Nugent, Harold E.
TITLE Teaching Critical Thinking: Protocols in the Classroom.
PUB DATE Mar 83
NOTE 12p.; Paper presented at the Annual Meeting of the Conference on College Composition and Communication (34th, Detroit, MI, March 17-19, 1983).
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052) -- Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Class Activities; Classroom Communication; *Critical Thinking; Group Activities; Higher Education; *Oral Language; *Problem Solving; Reading Skills; Skill Development; *Teaching Methods
IDENTIFIERS *Protocol Analysis

ABSTRACT

The use of protocols--oral verbalizations of the problem solving process--in a critical thinking and problem solving class offers a number of advantages to students and teachers alike. Protocols help students (1) learn to read problems carefully; (2) focus on the important characteristics of specific problems; (3) slow down their problem-solving methods and break problems into manageable parts; (4) identify, practice, and evaluate problem-solving strategies; and (5) experience peer support in nonthreatening, process-oriented situations. After students have practiced with relatively simple, structured problems, they can use protocols in a wide variety of complex reading and writing activities involving analysis, synthesis, or persuasion. Protocols also provide teachers with a helpful diagnostic tool. They offer insight into the problem solving process, help teachers identify strengths and weaknesses in students' problem solving processes, and indicate where to intervene in students' problem solving efforts. (MM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
[X] This document has been reproduced as received from the person or organization originating it.
[ ] Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Susan Monroe Nugent
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED236675

Teaching Critical Thinking: Protocols in the Classroom

Susan Monroe Nugent and Harold E. Nugent

"If you are facing east and turn left, then make an about-face and turn left again, in which direction are you facing?" (Whimbey and Lockhead, p.6) Working together in pairs around the room, students try solving this problem. One student rips a piece of paper out of her notebook and labels North, South, East and West. Another student stands up stating, "OK, that's East." He then turns left, saying, "I'm now heading North." Another student turns the top half of her body as she reads, but remains seated. Others draw arrows, circles, and doodles while orally solving this problem. One student becomes embarrassed when she realizes we are watching. "Yes, I really am a freshman in college," she giggles. Her partner's face looks like a stop light. Yes, these students are freshmen in college. This situation is the result of protocols, the first ones of the semester. These protocols (oral verbalization of the process involved in solving problems) are to become a daily part of this class on critical thinking and problem solving.

In the critical thinking and problem solving class at Keene State College, protocols serve both as a teaching tool and as a diagnostic instrument. Students who practice protocols become more aware of and use more effective problem-solving techniques. Teachers who listen to these protocols learn what prevents students from reaching a solution as well as what processes enable students to discover answers. These protocols help us know how we can beneficially intervene in this process.

CS 207951

The course on critical thinking and problem solving was developed in response to the growing number of first year students who lack adequate practice in reasoning as applied to problems found in their classes. The emphasis of this course is on problem solving as it relates to reasoning, reading, and writing. In our interdisciplinary course, Critical Thinking, these skills are taught separately in order to prevent conceptual overload which so often results when simultaneous demands are made on the average and underprepared student.[1]

The protocols previously described are illustrations of a teaching tool we have found very effective in increasing critical thinking and problem-solving skills. Protocols require the problem solver to verbalize orally as much of the problem-solving process as possible. Each problem solver within the class has a partner who encourages the problem solver to keep exploring the problem orally. This approach differs from previous uses of protocols. In the past, protocols have been utilized primarily as a research tool, not a teaching tool. Linda Flower and John R. Hayes of Carnegie-Mellon are two researchers who developed this tool that provides a number of insights into the composing processes of writers.[2]

Because the concept of protocols is new to students, protocols are first introduced utilizing well defined yet relatively unrealistic problems such as those found in Whimbey and Lockhead's Problem Solving and Comprehension. The first problem-solving situation described in the introduction to this paper is an example of these highly structured assignments. Once the concept of protocols is understood and practiced, students can then do protocols in more realistic thinking, reading, or writing situations.

The benefits of protocols for students are many. By examining protocols for another introductory problem, these benefits become apparent:

> Dracula hates daylight more than Wolfman unless Frankenstein hates daylight more than Dracula. In that case Wolfman hates daylight more than Dracula but less than Mummy. Mummy hates daylight more than Dracula but less than Frankenstein. Show a diagram of the monsters ordered according to their hatred of daylight. (Whimbey and Lockhead, p.121)

Protocols illustrate that in this problem students often miss the unless in the first sentence. Orally solving the problem, students often return to that sentence two or three times in an attempt to find out the precise meaning of the passage. A fully developed protocol reenforces careful reading of a problem. Skimming of this problem, on the other hand, often results in a failure to understand the problem. In order to reach a solution to the Wolfman problem, the students must read each word in the context of the problem. Slowing down the reading process has obvious carry-over to other situations. First, students begin to realize that there really is a purpose for varying reading rates. Consequently, after practice with protocols, students tend to read carefully both exam questions and writing assignments.

Careful reading also leads students to the second benefit: becoming aware of what the problem is. Precise reading encourages students to more readily focus on the problem. Instead of giving a response that Frankenstein hates daylight most, many students begin to draw a diagram of the monsters and chart the response. Students are solving the problem as assigned. This attention to what the problem really involves leads to students more effectively executing the intention of their assignments in classes across the disciplines. Students learn to recognize and respond to an exam question as written, not as they hoped it had been asked.

Another benefit of protocols is that such active involvement causes students to slow down their problem-solving methods. When a person has to explain how he or she is solving a problem while actually trying to solve the problem, it is difficult, if not impossible, to jump hastily to a conclusion. For example, although it would be easy to state that Wolfman hates daylight most, an explanation as to how the conclusion is reached is not as easy. In other words, if a student does not have to show how she/he came to a conclusion, it may often be easier to guess at a response. Guessing gets the student off the hook for the moment. After all, the student may be right. The emphasis, not on just giving an answer, but rather on explaining the process of reaching that answer forces students to demonstrate abilities that can be applied to other situations. The protocol process thus aids in bringing to the level of conscious awareness abilities necessary for effective transference of learning.

This step-by-step approach to problem solving requires students to work the whole way through a problem. When a student is verbalizing a problem, with an audience of either a peer, a tape recorder, or a teacher, we find the tendency to give up on a problem decreases. Instead, various approaches to the problem are tried. In the Wolfman problem, students slowly sort out what information is believable, what statement is <u>fact</u>, in order to start the diagram. Usually, there are false starts on this problem with several diagrams designed in relation to the first sentence.

Not being able to figure out exactly how to solve a large problem, more effective problem solvers try solving parts of the problem. The student works at breaking the problem into manageable parts. In this problem, the student diagrams the third sentence (Mummy hates daylight more than Dracula but less than Frankenstein), the one that gives information with no <u>unless</u> attached.

Each solution to a part of this problem leads to solution of the whole problem. Most assignments throughout college require students to break the problem into parts. Research papers, for instance, must be approached step-by-step. Protocols help establish this process.

A further benefit of protocols is that they provide opportunities for identification, practice, and evaluation of problem-solving strategies. For example, one characteristic of a good problem solver is activeness in the process. In the problem concerning directions previously described, students demonstrated various methods of getting actively involved. These include standing up and acting out the motions as well as drawing charts and diagrams. Partners have the opportunity to see how effective each chosen method is. What were the assets and liabilities of writing down the directions, creating a chart? Were arrows alone effective? In the protocol setting, students change partners in order to see other methods of problem solving. Learning what not to do is often as important as learning what to do. This constant observation and utilization of various strategies leads to students enlarging their repertoire of effective problem-solving techniques.

As students pair off each class period, they both listen to and demonstrate problem-solving methods. A student who may not utilize a chart for the Wolfman problem sees the advantages of one when his/her partner uses it. This working together in pairs allows students to try out various techniques without the pressure of a grade or teacher evaluation. The increased awareness of the problem-solving process results in a conscious use of effective strategies. As problem solvers gain experience, the application of these strategies becomes internalized. On multiple choice tests, for example, students who previously stopped reading the selections after coming to what they thought might be the

correct answer now consider all options before selecting the most appropriate response.

Peer support in protocols is productive. During the first few days of protocols, peers tend to make suggestions instead of just listening to the solution process. However, with model protocol demonstrations and with gentle reminders, one person becomes responsible for solving the problem. The classmate offers support, and in most cases, provides immediate feedback after a problem is solved. At the same time, a peer partner keeps the frustration level down in class. When a student obviously has reached a dead-end in a problem, one tiny hint from a partner can get the student back on track. That hint usually is in the form of a question, "What do we know for sure about Mummy?" or "What strategy did the text suggest?" This questioning puts the problem back into perspective for the student.

To summarize, the major benefits of protocols for students are:

1. Protocols reenforce careful reading of a problem.
2. Protocols help students become aware of what the problem is. Thus, students solve the right problem.
3. Protocols cause students to slow down their problem-solving methods. This step-by-step approach forces students to work through a problem, to break a problem into manageable parts.
4. Protocols provide opportunities for identification, practice, and evaluation of problem-solving strategies.
5. Protocols enlarge a student's repertoire of effective problem-solving strategies.
6. Protocols provide students with peer support in a non-threatening process-oriented situation.

After students have learned the process of giving and receiving protocols of such highly structured problems as previously described, we shift to less structured and more realistic reading and writing activities. These activities usually focus on one stage of the reading or writing process. However, since neither the reading nor writing process is linear, or step-by-step, the problems usually provide us with insight into the student's problem-solving strategies at several stages. The following chart provides sample activities utilized in class.

Problem	Focus	Skills and Subskills
Defining a strike or dialect	Reasoning	Matching strategies to problem; using vertical or lateral thinking, using temporal, causal, contrastive sequencing.
Analyzing and evaluating author's primary reason for writing	Reading	Identifying distinctions, value judgments, and technigues of proof.
Synthesizing and retaining information	Reading	Chunking information by identifying superordinate concepts.
Changing a reader's image of subject matter, e.g. nuclear war	Writing	Fitting subject matter to reader by identifying and signalling old and new information and by building bridges between shared and unshared values.
Exploring and convincing self or others on solution to family problem, e.g. where grandmother can best be cared for.	Reasoning, Reading, and Writing	All of the skills above as needed in varying degrees to acquire effective balance of attention to subject, purpose, writer, reader, and form.
Convincing a young doctor to take up medical practice in student's hometown.	Writing	Same as above.

Protocols of these reasoning, reading, and writing problems continue to benefit students as previously outlined. These protocols are also used as a diagnostic tool providing us with insight into problem-solving processes. By analyzing the strategies of a good problem solver, the complexity of many problems becomes extremely clear. For example, when Jeff attempted to convince a friend that solar power would benefit society, he discovered he needed information on alternative sources of power as well as on his friend's present beliefs. Decentering his own position, leaving out saturated words, was a difficult task for Jeff. Listening to Jeff's protocol made us realize that even more classroom time than already allotted needed to be spent on audience awareness in the writing process.

With gained insight into problem-solving processes, we are better able to identify strengths and weaknesses in student's problem-solving processes. One student, when asked to write a letter to a young medical doctor convincing the doctor to move to her hometown, centered first on the form. Caught up in a letter writing mode, she verbalized how she would explain why she was writing the letter, that she was representing a committee, and that she could tell him that she hoped he would move to Swanzey, New Hampshire. She would supply the doctor with her address, she would give him a deadline for response, and she would end by saying she looked forward to his reply. So concerned with form, Mary overlooked providing this young docotr with any information on Swanzey. Activities such as this one help us diagnose both student strengths and weaknesses.

Insight into a student's weaknesses leads to an understanding of the nature of the student's problem. For example, when Mary generated information for her letter, she focused on form, overlooking content. The weakness

is not that Mary has no knowledge of the content, but rather that her concern for the form of a letter subsumed the content. As mentioned previously, another benefit of protocols for teachers is that they help us determine where to intervene in the problem-solving process to most efficiently and effectively help a student. Without a protocol it might be assumed that Mary does not know how to generate content for a paper. However, as seen in this case, the best way to help Mary is to separate the form of a paper from the content, providing her the opportunity to look at each of these elements separately.

Another student turned in a paper on nuclear energy devoid of reasoning. David's statements were not supported; he appeared to lack knowledge of the subject. But returning to his protocol, we found that David knew much about the subject matter. However, he had somehow left this information out of his final paper. What he needed to work on was not how to generate information for a paper, but rather how to utilize a heuristic, that is, how to select the appropriate information from all the material that he generated for inclusion in the final draft. Without this protocol to provide us with information on David's problem-solving process, we would have probably taken considerable time to teach him an information generating procedure. Both his time and ours would have been largely wasted. He needed a method of evaluating material, not a heuristic.

Finally, protocols are an indication to the teacher of group problems, not just individual ones. For example, if one student's protocol indicates that this learner cannot picture his/her audience, does not have any awareness of what the audience needs to know about the subject, then this rhetorical problem probably is one that other members of the class are also experiencing. Thus, listening to one protocol can provide teachers with insights and possible solutions to class problems.

To summarize, protocols, as a diagnostic instrument, benefit teachers in many ways:

1. Protocols provide insight into problem-solving processes.
2. Protocols help teachers identify strengths and weaknesses in students' problem-solving processes.
3. Protocols indicate to us the nature of a student's problem.
4. Protocols help us to determine where to intervene in the problem-solving process to most efficiently and effectively help a student.
5. Protocols are an indication of group problems, not just individual ones.

In conclusion, the benefits of protocols for students and teachers are many. The problems related to them are relatively few. Although protocols may appear difficult to administer in the classroom, they are as easy as any pair grouping activity. Not all classroom protocols need to be taped. We prefer to have three or four tape recorders in the classroom at a time with the remainder of the pairs of students orally doing the problems, but not taping them. All protocols need not be made during class time. Students who own tape recorders can make protocols at home. Others can use recorders from the library or borrow a class tape recorder. Since protocols are utilized to examine the student's problem-solving processes, they can be gathered whenever the student is involved in a problem related to the class.

The problem-solving approach presented here contributes to our diagnostic techniques and our teaching strategies, consequently what we cover in the classroom. Based on the theory that protocols provide windows into the thinking, reading, and writing process, classroom use indicates that protocols can also provide insight into the problem-solver's problems. With this additional information, we, as teachers, can better solve our own very real problem: how to intervene effectively in reasoning, reading, and writing processes of our students.

Endnotes

[1]For theoretical underpinnings and design of this course, see Harold E. Nugent and Susan Monroe, "Critical Thinking and Problem Solving: The Evolution of a Course," ERIC, 1983.

[2]In addition to Flower and Hayes, a number of other teachers and researchers have recently published articles on protocols and protocol analysis. Especially interesting is a recent article by Muriel Harris (College English, January 1983) which discusses the use of protocols and modeling in a writing lab.

References

Flower, Linda and John R. Hayes. "Writing Research Seminar in Composition." Carnegie-Mellon University, June 1980.

Whimbey, Arthur and Jack Lockhead. Problem Solving and Comprehension. Philadelphia: Franklin Institute Press, 1980.